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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/540,629	06/23/2005	Yuichi Tokita	S1459.70075US00	5380
23628 7590 03/16/2007 WOLF GREENFIELD & SACKS, PC FEDERAL RESERVE PLAZA 600 ATLANTIC AVENUE BOSTON, MA 02210-2206			EXAMINER MCDONALD, RODNEY GLENN	
			ART UNIT 1753	PAPER NUMBER
SHORTENED STATUTORY PERIOD OF RESPONSE		MAIL DATE	DELIVERY MODE	
3 MONTHS		03/16/2007	PAPER	

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/540,629	<b>Applicant(s)</b> TOKITA ET AL.	
	<b>Examiner</b> Rodney G. McDonald	<b>Art Unit</b> 1753	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 21 February 2007.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1 and 3-11 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1 and 3-11 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### ***Continued Examination Under 37 CFR 1.114***

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on February 21, 2007 has been entered.

### ***Claim Rejections - 35 USC § 112***

Claims 1-11 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for the N dye ( cis-bis(2,2'-bipyridine)-dicyanate ruthenium) on the nanotubes to produce a photoelectric transfer efficiency of the photoelectric transfer device to be greater than about 10%, does not reasonably provide enablement for ***all dyes having no acidic substituents*** to produce a photoelectric transfer efficiency of the photoelectric transfer device to be greater than about 10%. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to practice the invention commensurate in scope with these claims. IT should be noted that the ZnTPP which is a dye having no acidic substituents does not produce a photoelectric efficiency of greater than about 10%.

Claims 1-11 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to

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one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Specifically, the range of "greater than about 10%" is not supported in the specification. While 10.2% is exemplified in the specification the range entirety of the range is not supported by the specification. (i.e. 11%, 15%, etc.).

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1 and 5-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Adachi et al. "Dye-sensitized Solar Cells Using Semiconductor Thin Film Composed of Titania Nanotubes", Electrochemistry, June 2002, Volume 70, No. 6, pp. 449-452 in view of Graetzel et al. (U.S. Pat. 5,350,644).

Regarding claims 1, 11, Adachi et al. teach a dye sensitized photoelectric transfer device prepared by forming a semiconductor layer containing titania nanotubes that are sensitized with a ruthenium dye (see the Experimental pages 449-450). Adachi et al soaks the titania nanotubes (which are coated on a glass substrate) in an ethanol solution of ruthenium dye for 20 hr the dye-sensitized titania nanotubes (see page 450). It is the Examiner's position that this inherently results in the dye being "retained" by the nanotubes.

Regarding claim 5, the diameter of each nanotube is 10 nm. (See page 450)

Regarding claim 6, the titania nanotubes are formed as anatase crystal. (See Abstract)

Regarding claim 7, there is a semiconductor layer and an electrolyte layer provided between a pair of opposed electrodes. (See Page 450)

Regarding claim 8, there is a semiconductor layer (titania) and an electrolyte layer provided between a transparent conductive substrate (tin oxide) and a conductive substrate as a counter electrode (Pt) of the transparent conductive substrate to generate electric energy between the transparent conductive substrate and the conductive substrate by photoelectric transfer. (See Page 459, 450)

Regarding claim 9, there is a transparent glass substrate having a doped tin oxide conductive film. (See Page 449)

Regarding claim 10, the transfer device is configured as a dye sensitized solar cell. (See page 450)

The difference between Adachi et al. and the present claims is that the dye having no acidic substituents is not discussed (Claim 1) and the photoelectric transfer efficiency being greater than about 10% is not discussed (Claim 1) .

Regarding the dye having no acidic substituents (Claims 1, 11), Graetzel et al. teach in Table 1 in Examples 7 (i.e. Ru (2, 2'-bipyridyl)<sub>2</sub>(CN)<sub>2</sub>) and 8 a dye for a photoelectric transfer device that has no acidic substituents. (See Table 1 Column 9 Examples 7, 8; Column 9 lines 57-59)

Regarding the photoelectric transfer efficiency being greater than about 10% (Claims 1, 11), Graetzel et al. teach in Example 36 achieving a photoelectric transfer efficiency of 11%. (Column 14 lines 24-25) Graetzel et al. teach that the complexes of Examples 1-33 (i.e. see Examples 7, 8 of Table 1) can be used in place of the complexes of Example 36 to achieve a similar result. (Column 16 lines 36-39)

The motivation for utilizing the features of Graetzel et al. is that it allows for producing a photoelectric transfer device with higher efficiency than the conventional device. (Column 14 lines 31-32)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Adachi et al. by utilizing the features of Graetzel et al. because it allows for producing a photoelectric transfer device with higher efficiency than the conventional device.

Claims 3 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Adachi et al. as applied to claims 1, 5-11 above, and further in view of Wariishi et al (U.S. Patent 6,376,765) and Yoshikawa (U.S. Patent 6,586,670).

The differences not yet discussed are the titania nanotube retaining at least two kinds of sensitizing dye is not discussed (Claim 3) and the particles of the dyes not associating is not discussed (Claim 4).

Regarding claim 3, Wariishi et al teaches dyes that can be used in dye-sensitized solar cells (see col. 26, lines 56 through col. 54). Many dyes, such as dyes S-1, S-3 to S-20, S-22, S-23, S-27 to S-29, S-33, S-37 and S-41, among the dyes illustrated by Wariishi et al do not contain acidic groups (see col. 47 through col. 52). Wariishi et al also teaches that two or more dyes may be used as a mixture to obtain a large photoelectric conversion region and a high photoelectric conversion efficiency (see col. 26, lines 59-62). Yoshikawa also teaches dyes that can be used in dye-sensitized solar cells, such as dye M-1 at col. 24, which does not contain acidic groups. Yoshikawa also teaches that two or more dyes may be used as a mixture to obtain a large photoelectric conversion region and a high photoelectric conversion efficiency (see col. 20, lines 62-66).

Regarding claim 4, Yoshikawa teaches that a colorless compound may be co-adsorbed together with the dyes to weaken an interaction between the dyes, such as association (see col. 13, lines 42-49). Thus, even if there was association of dyes, a skilled artisan would know how to weaken this interaction so that there is essentially no association. It would have been obvious to one of ordinary skill in the art at the time the invention was made to have used a dye that has no acidic groups as the sensitizing dye because such dyes are conventional in the art, as shown by Wariishi et al and Yoshikawa.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have used mixtures of dyes because with mixtures of dyes a large photoelectric conversion region and a high photoelectric conversion efficiency can be obtained, as shown by Wariishi et al and Yoshikawa.

Furthermore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have prevented association of the dyes because it is known in the art that a colorless compound may be co-adsorbed together with the dyes to weaken an interaction between the dyes, such as association, as taught by Yoshikawa.

### ***Response to Arguments***

Applicant's arguments filed January 22, 2007 have been fully considered but they are not persuasive.

In response to the argument that unexpected results have been shown, it is argued that the unexpected results are not commensurate in scope with the claimed subject matter. The question is whether all sensitizing dyes having no acidic substituents will produce the result of a photoelectric transfer efficiency of greater than about 10%. Applicant has exemplified two species and only one achieves the required transfer efficiency of the claims. MPEP 706.02(d) states that whether the unexpected results are the result of unexpectedly improved results or a property not taught by the prior art, the "objective evidence of nonobviousness must be commensurate in scope with the claims which the evidence is offered to support." In other words, the showing of unexpected results must be reviewed to see if the results occur over the entire claimed



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range. In re Clemens, 622 F.2d 1029, 1036, 206 USPQ 289, 296 (CCPA 1980). See Also In re Peterson, 315 F.3d 1325, 1329-31, 65 USPQ2d 1379, 1382-85 (Fed. Cir. 2003) (data showing improved alloy strength with the addition of 2% rhenium did not evidence unexpected results for the entire claimed range of about 1-3% rhenium).

Also MPEP 716.02(e) mentions comparison with closest prior art. An affidavit or declaration under 37 CFR 1.132 must compare the claimed subject matter with the closest prior art to be effective to rebut a prima facie case of obviousness. In re Burckel, 592 F.2d 1175, 201 USPQ 67 (CCPA 1979). "A comparison of the claimed invention with the disclosure of each cited reference to determine the number of claim limitations in common with each reference, bearing in mind the relative importance of particular limitations, will usually yield the closest single prior art reference." In re Merchant, 575 F.2d 865, 868, 197 USPQ 785, 787 (CCPA 1978) (emphasis in original). Where the comparison is not identical with the reference disclosure, deviations therefrom should be explained; In re Finley, 174 F.2d 130, 81 USPQ 383 (CCPA 1949), and if not explained should be noted and evaluated, and if significant, explanation should be required. In re Armstrong, 280 F.2d 132, 126 USPQ 281 (CCPA 1960) (deviations from example were inconsequential). Specifically newly cited reference to Graetzel et al. shows in Table 1 Example 7 a dye that has no acidic substituents. It is expected from the disclosure of Graetzel et al. such dye would produce efficiency of 11% since Graetzel et al. equates all disclosed dyes at Column 16 lines 36-38. Also Graetzel et al.'s exemplified dye of Ru (2, 2'-bipyridyl)<sub>2</sub>(CN)<sub>2</sub> is similar if not the same as Applicant's

N dye (cis-bis(2,2'-bipyridine)-dicyanate ruthenium) disclosed on Applicant's specification of Page 20.


The Examiner also argues that when using dyes with titanium nanotubes the efficiency of the cell will be increased. This use of titania nanotubes for improving efficiency is shown by Adachi et al. on Page 451 and Fig 4 which shows that the efficiency of the cell is related to photocurrent density. For titania nanotubes photocurrent density is much greater than for films of titania P-25.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rodney G. McDonald whose telephone number is 571-272-1340. The examiner can normally be reached on M- Th with Every other Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam X. Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Rodney G. McDonald  
Primary Examiner  
Art Unit 1753

RM  
March 14, 2007